

## **Appendix C. Copies of Project File Documents Referenced in the BA/BE**

### **Aquatics Project File Document AQUATICS-003 Effectiveness of RHCAs to protect aquatic habitat conditions**

One of the primary design features of the Mud Creek project is the incorporation of INFISH Riparian Habitat Conservation Area buffers, as described in the project design criteria.

There is a substantial body of literature suggesting that the PACFISH/INFISH buffers effectively prevent the delivery of sediment to streams. Belt and others (1992) concluded, based on studies conducted in Idaho (Haupt 1959a and 1959b, Ketcheson and Megahan 1996, Burroughs and King 1985 and 1989) and elsewhere (Trimble and Sartz 1957, Packer 1967, Swift 1986) that sediment rarely travels more than about 91 meters for non-channelized flow. Therefore, 91-meter filter strips are generally effective in controlling sediment that is not channelized. Trimble and Sartz 1957, recommended that where the highest possible water quality standard was required, this could be maintained with 100 meter buffer strips on 70 percent slopes.

There is also a substantial body of literature supporting that the same RHCA buffers would also be sufficient to provide riparian functions (Gregory et al. 1987, Beschta et al. 1987, Brazier and Brown 1973, Steinblums and others 1984, McDade and others 1990, Sedell and Beschta 1991, Belt and others 1992). These functions include litterfall and nutrient input and retention in streams (23 to 46 meters), shade to streams for maintenance of summer stream temperatures (23 to 46 meters), woody debris delivery (30 to 46 meters), and stream bank stability (23 to 46 meters). RHCA widths for intermittent streams should protect small channels from large volumes of sediment and water that could be generated by land management activities and be channeled into fish bearing streams.

#### **EFFECTIVENESS MONITORING DATA**

The PACFISH/INFISH strategies have been in place since 1995 and a substantial body of implementation and effectiveness monitoring data support that the strategy is effective in both preventing sediment inputs into stream channels as well as protecting the components of riparian areas important for creating and maintaining habitat for native fishes.

#### **LOCAL MONITORING DATA**

Monitoring of vegetation management projects on the Bitterroot National Forest since the amendment of the INFISH strategy to the Forest Plan have indicated that incorporation of RHCA buffers combined with application standard BMPs have consistently prevented delivery of sediment to fishbearing streams. In 100% of hundreds of vegetation treatment units that were monitored post-project showed no sign of sediment exiting harvest units, crossing RHCA boundaries, and moving towards streams. Likewise, projects cause no measurable changes in water temperatures, sediment levels, woody debris recruitment, or fish habitat structure > 300 vegetation treatment units that were monitored post-project (M. Jakober pers. Comm. 3-1-2018; detailed monitoring reports are available in the Forest Plan Monitoring Reports, Item 22 chapters from 2003 to the present).

Various field reviews and monitoring activities across the landscape that is managed under PACFISH/INFISH strategies (including the incorporation of PACFISH/INFISH buffers) support the conclusion that the aquatic habitat conditions have improved since monitoring began in 1998. Much of the recovery is likely a result of less land disturbing activities, better application of BMPs, RHCA retention, and better road design.

#### **REGIONAL MONITORING DATA**

The PACFISH INFISH Biological Opinion (PIBO) Effectiveness Monitoring program was established to answer the question: *“Are key biological and physical components of aquatic and riparian communities being improved, degraded, or restored within the range of steelhead (*Oncorhynchus mykiss*) and bull trout (*Salvelinus confluentus*)?”*

PIBO Effectiveness monitoring has been carried out multiple times on over 1,300 sites throughout the range of the bull trout and steelhead trout since 2001 to determine whether the PACFISH/INFISH conservation strategy (which includes the system of protective RHCA buffers described above) are effective in protecting the key functions of riparian areas that create and maintain habitat for native fish. The monitoring program compares habitat conditions in reference or unmanaged reaches to managed reaches in order to identify where managed reaches are lacking in habitat integrity (status). The program also evaluates trend in habitat conditions thru time to evaluate the effects of the implementation of PACFISH/INFISH.

PIBO monitoring results for the Upper Columbia River Basin indicate improving trends in pool depth, bank stability, large wood frequency and volume in both reference and managed sites (Meredith et al. 2011 and 2012). There were no significant trends for percent fines, and negative trends in the percent of pools were observed in both reference and managed sites. Because the trends were similar at both reference and managed sites, they surmised that the lack of or negative trends in percent fines and pools may not be management related. A summary of PIBO data collected between 2001 and 2013 just within Region 1 of the Forest Service showed desired trends in all parameters except for percent pools (Archer and Groce 2016, unpublished report). Percent pools had an overall 2% decrease where increases would have been expected. The overall percent pool tail fines (a measure of fine sediment) decreased by 14% within the region, which is the desired trend for sediment.

A 2017 analysis of PIBO data performed by Archer and Ojala (unpublished report) showed improving trends in multiple metrics, including covered stable banks, percent undercut banks, abundance of large woody debris, median particle size, pooltail fines, macro invertebrates as the overall index of habitat integrity. The data suggests that PACFISH/INFISH RHCAs are highly effective at reducing impacts to streams and riparian areas from management activities.

A 2019 research paper published by Roper et al. (2019) showed that nine of the ten stream attributes monitored by the PIBO program were either stable or improving in managed stream reaches across the interior Columbia River basin. The authors concluded that the changes in federal land management policies that occurred in the 1990s (i.e. the PACFISH and INFISH amendments to Land and Resource Management Plans) likely played a meaningful role in maintaining or improving habitat conditions important to salmonids.

## REFERENCES CITED

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- Beschta, R.L., R.E. Bilby, G.W. Brown, L.B. Holtby, and T.D. Hofstra. 1987. Stream temperature and aquatic habitat: Fisheries and forestry interactions. Pp. 191-232 in E.O. Salo and T.W. Cundy, eds. Streamside management: Forestry and Fishery Interactions. University of Washington, Seattle, WA.
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Gregory, S.V., Lamberti, G.A., Erman, D.C., Koski, K.V., Murphy, M.L., and J.R Sedell. 1987. Influence of forest practices on aquatic production. Pages 234-255 in E.O. Salo and T. W. Cundy. eds. *Streamside Management: Forest and Fishery Interactions: Proceedings of a Symposium*, Institute of Forest Resources, University of Washington, Seattle.

Haupt H.F. 1959a. A Method for Controlling Sediment Movement from Logging Roads. Inter-mountain Forest and Range Experimental Station. Misc. Publ. 22. Boise, ID, USA

Haupt, H.F. 1959b. Road and slope characteristics affecting sediment movement from logging roads. *J. For.* 57:329–332.

Ketcheson, G.L. and W.F. and Megahan 1996. Sediment Production and Downslope Sediment Transport from Forest Roads in Granitic Watersheds. United States Department of Agriculture Forest Service Intermountain Research Station Research Paper INT-RP-486, May 1996, 16 pp.

McDade, M.H., F.J. Swanson, N.A. McKee, J.F. Franldine, and J. Van Sickle. 1990. Source distances for coarse woody debris entering small streams in western Oregon and Washington. *Canadian Journal Forest Resources* 20:326-330.

Meredith, C., Archer, E.D., Scully, R., Van Wagenen, A., Ojala, J., Hough-Snee N., and B.B. Roper. 2011. PIBO Effectiveness Monitoring Program for Streams and Riparian Areas. USDA Forest Service 2011 Annual Summary Report. 42 pp.

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Packer, P. E. 1967. Criteria for designing and locating logging roads to control sediment. *For. Sci.* 13:1-18.

Roper, B.B., W.C. Saunders, and J.V. Ojala. 2019. Did changes in western federal land management policies improve salmonid habitat in streams on public lands within the Interior Columbia River Basin? *Environ Monit Assess* (2019) 191:574.  
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Sedell, J. R., and R. L. Beschta. 1991. Bringing back the “bio” in bioengineering. *American Fisheries Society Symposium* 10:160–175.

Steinblums, L.L., H.A. Froehlich, and J.K. Lyons. 1984. Designing stable buffer strips for stream protection. *Journal of Forestry* 88: 49-52.

Swift, L.W. Jr. 1986. Filter strip widths for forest roads in the southern Appalachians. *Southern Journal of Applied Forestry* 10(1): 27-34.

Trimble, G.R. and R.S. Sartz. 1957. How far from a stream should a logging road be located? *J. For.* 55:339-341.

USDA Forest Service. 2002 through 2014-15. Forest Plan Monitoring Reports. Bitterroot National Forest. Hamilton, Montana.

USDA Forest Service. 2019a. DRAFT Biennial Monitoring Evaluation Report (MER) for the Bitterroot National Forest. Forest Plan Monitoring and Evaluation Report, Fiscal Year 2019. Monitoring Item AQT-03 – Riparian Habitat. Bitterroot National Forest. Hamilton, Montana.

# **Aquatics Project File Document AQUATICS-005**

## **Citations for design element effectiveness**

The citations listed below document monitoring of the effectiveness of aquatic design elements.

### **Timber sales (RHCA effectiveness, log landings, temp roads, skid trails, yarding conditions)**

Project File Document AQUATICS-003

Project File Document AQUATICS-004

USDA Forest Service, 2002: Item 22, pg 80

USDA Forest Service, 2003: Item 22, pgs 76-78

USDA Forest Service, 2004: Item 22, pgs 87-94

USDA Forest Service, 2005: Item 22, pgs 63-67

USDA Forest Service, 2006: Item 22, pgs 76-83

USDA Forest Service, 2007: Item 22, pgs 90-98

USDA Forest Service, 2008: Item 22, pgs 81-85

USDA Forest Service, 2009: Item 22, pgs 70-74

USDA Forest Service, 2010-2013: Item 22, pgs 126, 131-143

USDA Forest Service, 2014-2015: Item 22, pgs 59, 62-66

USDA Forest Service, 2019a: Monitoring Item AQT-03

SpringerFirewoodTS\_mj\_113018 (unit log from Springer Firewood timber sale; Nov 30, 2018)

SpringerFirewoodTS\_mj\_121118 (unit log from Springer Firewood timber sale; Dec 11, 2018)

SpringerFirewoodTS\_mj\_121918 (unit log from Springer Firewood timber sale; Dec 19, 2018)

SpringerFirewoodTS\_mj\_013019 (unit log from Springer Firewood timber sale; Jan 30, 2019)

SpringerFirewoodTS\_mj\_020719 (unit log from Springer Firewood timber sale; Feb 7, 2019)

SpringerFirewoodTS\_mj\_022219 (unit log from Springer Firewood timber sale; Feb 22, 2019)

SpringerFirewoodTS\_mj\_031119 (unit log from Springer Firewood timber sale; Mar 11, 2019)

SpringerFirewoodTS\_mj\_032019 (unit log from Springer Firewood timber sale; Mar 20, 2019)

SpringerFirewoodTS\_mj\_032919 (unit log from Springer Firewood timber sale; Mar 29, 2019)

SpringerFirewoodTS\_mj\_040519 (unit log from Springer Firewood timber sale; Apr 5, 2019)

SpringerFirewoodTS\_mj\_041119 (unit log from Springer Firewood timber sale; Apr 11, 2019)

MeadowVaporTS\_mj\_112119 (unit log from Springer Firewood timber sale; Nov 21, 2019)

### **Log hauling and timber sale-associated road maintenance**

USDA Forest Service, 2003: Item 22, pgs 80-82

USDA Forest Service, 2004: Item 22, 87-88, 97

USDA Forest Service, 2005: Item 22, pgs 69-70

USDA Forest Service, 2006: Item 22, pgs 76-78, 84-85

USDA Forest Service, 2007: Item 22, pgs 91-95, 102-103

USDA Forest Service, 2008: Item 22, pgs 82-84

USDA Forest Service, 2009: Item 22, pgs 71-73

USDA Forest Service, 2010-2013: Item 22, pgs 131-142

USDA Forest Service, 2014-2015: Item 22, pgs 59-60, 65

USDA Forest Service, 2019a: Monitoring Item AQT-03

SpringerFirewoodTS\_mj\_113018 (unit log from Springer Firewood timber sale; Nov 30, 2018)

MeadowVaporTS\_mj\_110419 (unit log from Meadow Vapor timber sale; Nov 4, 2019)  
SpringerFirewoodTS\_mj\_121118 (unit log from Springer Firewood timber sale; Dec 11, 2018)  
SpringerFirewoodTS\_mj\_121918 (unit log from Springer Firewood timber sale; Dec 19, 2018)  
SpringerFirewoodTS\_mj\_013019 (unit log from Springer Firewood timber sale; Jan 30, 2019)  
SpringerFirewoodTS\_mj\_020719 (unit log from Springer Firewood timber sale; Feb 7, 2019)  
SpringerFirewoodTS\_mj\_022219 (unit log from Springer Firewood timber sale; Feb 22, 2019)  
SpringerFirewoodTS\_mj\_031119 (unit log from Springer Firewood timber sale; Mar 11, 2019)  
SpringerFirewoodTS\_mj\_032019 (unit log from Springer Firewood timber sale; Mar 20, 2019)  
SpringerFirewoodTS\_mj\_032919 (unit log from Springer Firewood timber sale; Mar 29, 2019)  
SpringerFirewoodTS\_mj\_040519 (unit log from Springer Firewood timber sale; Apr 5, 2019)  
SpringerFirewoodTS\_mj\_041119 (unit log from Springer Firewood timber sale; Apr 11, 2019)

### **Straw bale check dams**

USDA Forest Service, 2007: Item 22, pgs 92-94, 96  
USDA Forest Service, 2008: Item 22, pgs 83-84  
USDA Forest Service, 2009: Item 22, pgs 71-73  
USDA Forest Service, 2010-2013: Item 22, pgs 131-133, 135-137, 139-140  
USDA Forest Service, 2014-2015: Item 22, pgs 59-62  
SpringerFirewoodTS\_mj\_102418 (unit log from Springer Firewood timber sale; Oct 24, 2018)  
MeadowVaporTS\_mj\_053019 (unit log from Meadow Vapor timber sale; May 30, 2019)  
MeadowVaporTS\_mj\_102219 (unit log from Meadow Vapor timber sale; Oct 22, 2019)  
MeadowVaporTS\_mj\_110419 (unit log from Meadow Vapor timber sale; Nov 4, 2019)  
SpringerFirewoodTS\_mj\_050119 (unit log from Springer Firewood timber sale; May 1, 2019)

### **Prescribed fire**

USDA Forest Service, 2007: Item 22, pg 80  
USDA Forest Service, 2008: Item 22, pgs 67-68  
USDA Forest Service, 2009: Item 22, pg 60  
USDA Forest Service, 2010-2013: Item 22, pgs 105-112  
USDA Forest Service, 2014-2015: Item 22, pgs 43-46  
USDA Forest Service, 2019a: Monitoring Item AQT-03  
LowerWestFork\_mj\_050218 (unit log from Lower West Fork prescribed burn; May 2, 2018)  
LowerWestFork\_mj\_110118 (unit log from Lower West Fork prescribed burn; Nov 1, 2018)  
MiddleEastFork\_mj\_050918 (unit log from Middle East Fork prescribed burn; May 9, 2018)  
SchoolPoint\_mj\_050418 (unit log from School Point prescribed burn; May 4, 2018)  
TepeeFace\_mj\_102518 (unit log from Tepee Face prescribed burn; Oct 25, 2018)  
LowerWestFork\_mj\_052819 (unit log from Lower West Fork prescribed burn; May 28, 2019)  
SchoolPoint\_mj\_061719 (unit log from School Point prescribed burn; Jun 17, 2019)

### **Road decommissioning and storage**

USDA Forest Service, 2003: Item 22, pg 79  
USDA Forest Service, 2005: Item 22, pgs 67-68  
USDA Forest Service, 2006: Item 22, pg 84  
USDA Forest Service, 2007: Item 22, pgs 98-102  
USDA Forest Service, 2008: Item 22, pgs 85-88  
USDA Forest Service, 2008: Item 21-41, pgs 128-129

USDA Forest Service, 2009: Item 22, pgs 74, 77  
USDA Forest Service, 2010-2013: Item 22, pgs 142, 144-147  
USDA Forest Service, 2014-2015: Item 22, pgs 68, 70  
USDA Forest Service, 2019a: Monitoring Item AQT-03  
bar\_road\_decom\_13833\_mj\_091218 (unit log from FR 13833 storage; Sep 12, 2018)  
bar\_road\_decom\_73213\_mj\_101018 (unit log from FR 73213 decommissioning; Oct 10, 2018)  
bar\_road\_decom\_gilbert\_mj\_091318 (unit log from Gilbert decommissioning project; Sep 13, 2018)  
bar\_road\_decom\_13833\_mj\_091819 (unit log from FR 13833 storage; Sep 18, 2019)  
bar\_road\_decom\_73213\_mj\_101819 (unit log from FR 73213 decommissioning; Oct 18, 2019)  
bar\_road\_decom\_gilbert\_mj\_092319 (unit log from Gilbert decommissioning project; Sep 23, 2019)

### **Culvert replacement and removal**

USDA Forest Service, 2003: Item 21-41, pgs 105-108  
USDA Forest Service, 2004: Item 21-41, pgs 94-95, 127-131  
USDA Forest Service, 2005: Item 22, pgs 67-68  
USDA Forest Service, 2005: Item 21-41, pgs 105-108  
USDA Forest Service, 2006: Item 22, pgs 83-84  
USDA Forest Service, 2006: Item 21-41, pgs 120-124  
USDA Forest Service, 2007: Item 22, pgs 99-100, 102  
USDA Forest Service, 2007: Item 21-41, pgs 136-142  
USDA Forest Service, 2008: Item 22, pgs 85-87  
USDA Forest Service, 2008: Item 21-41, pgs 121-131  
USDA Forest Service, 2009: Item 22, pgs 74-77  
USDA Forest Service, 2009: Item 21-41, pgs 120-127  
USDA Forest Service, 2010-2013: Item 22, pgs 145-147  
USDA Forest Service, 2010-2013: Item 21-41, pgs 230-239  
USDA Forest Service, 2014-2015: Item 22, pgs 68-70  
USDA Forest Service, 2014-2015: Item 21-41, pgs 117-124  
USDA Forest Service, 2019a: Monitoring Item AQT-01  
BushCrFR726CulvertReplacement\_mj\_052919 (unit log from Bush Cr FR 726 culvert replacement; May 29, 2019)

### **Dispersed campsite rehabilitation**

USDA Forest Service, 2001: Item 22, pgs 87-88  
USDA Forest Service, 2002: Item 22, pg 73  
USDA Forest Service, 2003: Item 22, pg 69  
USDA Forest Service, 2005: Item 22, pg 54  
USDA Forest Service, 2006: Item 22, pg 65  
USDA Forest Service, 2007: Item 22, pgs 72-77  
USDA Forest Service, 2009: Item 22, pgs 52-53  
USDA Forest Service, 2010-2013: Item 22, pgs 90-91, 98-100  
USDA Forest Service, 2014-2015: Item 22, pgs 40-43  
USDA Forest Service, 2019a: Monitoring Item AQT-03

### **Manual thinning, piling, and pile burning**

USDA Forest Service, 2006: Item 22, pg 68

LowerWestFork\_mj\_050218 (unit log from Lower West Fork prescribed burn; May 2, 2018)

LowerWestFork\_mj\_110118 (unit log from Lower West Fork prescribed burn; Nov 1, 2018)

MiddleEastFork\_mj\_050918 (unit log from Middle East Fork prescribed burn; May 9, 2018)

SchoolPoint\_mj\_050418 (unit log from School Point prescribed burn; May 4, 2018)

TepeeFace\_mj\_102518 (unit log from Tepee Face prescribed burn; Oct 25, 2018)

SchoolPoint\_mj\_061719 (unit log from School Point prescribed burn; Jun 17, 2019)

### **Citations**

Unit logs. 2018-2019. These logs document Michael Jakober's monitoring of 2018-2019 timber, prescribed fire, and culvert replacement projects. Copies are available upon request from the West Fork Ranger District (406-821-3269).

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